Work Plan and Methodology

Experimental Test Setup

Fig. 1 shows the test rig set up for the experimental study. It consists of a test-bed, a diesel engine, a dynamometer, a fuel tank, a data acquisition system, a computer, an operation panel, exhaust emission analyzers, and the exhaust temperature at the manifold, etc.

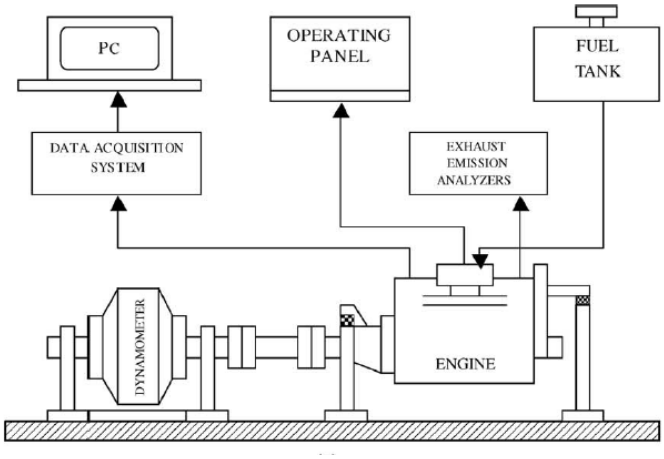

Fig – 01

The Engine

Model	Kirloskar Make AV1
Type	Water – cooled, four-stroke
Number of cylinders	1
Compression ratio	VCR
Rotation	Clockwise
Bore	85 mm
Stroke	110 mm
Aspiration	Normal
Speed	1800 rpm
Continuous power output	3.75 kW at 1500 rpm
Fuel consumption	Approximate at 100% load,
1500 rpm –	2.7 l/h; Approximate at 75% load,

Emission Analyzer

Exhaust gas analyzers, made by Richard Oliver Ltd, UK will be used to analyze the exhaust emissions from the engine, i.e. carbon monoxide, carbon dioxide, hydrocarbon and oxides of nitrogen. Prior to testing, the analyzers will be calibrated.

Specifications

Model No Smoke Check 6000
Supply 240 VAC, 50 Hz, 120 VA
Richard Oliver LTD K, Make

Experimental Plan

A plan will be designed for the experimental investigation. Different blends of fuels by volume will be tested. The fuel blends will be 10%, 20%, 30%, 40% & 50% i.e. blends of 10% vegetable oil with 90% diesel fuel, etc. 100% vegetable oil and 100% of diesel fuel, as shown in Table 1. The tests will be then conducted for different compression ratio and will be repeated for six times for every kind of fuel, in order to increase the reliability of the test results. For each of the fuels and Compression ratio, the engine will rn on five different loads, i.e. idle (0%), 25%, 50%, 75% and 100% of engine full loads. The engine load will controlled by dynamometer. During the tests, the parameters will be recorded as shown in Table 2

Table - 01

Run	Compression Ratio	Fuel	Frequency Tested
R01	CR1	A	6
		B	6
		C	6
		D	6
		E	6
R02	CR2	A	6
		B	6
		C	6
		D	6
		E	6
R03	CR3	A	6
		B	6
		C	6
		D	6
		E	6
R04	CR4	A	6
		B	6
		C	6
		D	6
		E	6
R05	CR5	A	6
		B	6
		C	6
		D	6
		E	6

Table – 02

Sr. No	Description		Compression Ratio																									
		Run →	R01					R02					R03					R04					R05					
		Fuel →	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	
1	Net load	%																										
2	Speed of Engine N	RPM																										
3	Manometer reading (hw=h1-h2)	mm																										
4	Fuel Consumption	Sec																										
5	Time required for circulating 1 lit of water through engine jacket(Mwj)	Sec/lit																										
6	Water inlet temperature to engine jacket(Twi)	^{0}C																										
7	Water outlet temperature from engine jacket(Two)	^{0}C																										

8	Time required for circulating 1 lit of water through calorimeter (Mwc)	Lit/sec																										
9	Water inlet temperature to calorimeter(T1)	^{0}C																										
10	Water outlet temperature to calorimeter(T2)	^{0}C																										
11	Exhaust gas temp.inlet to calorimeter(T3)	^{0}C																										
12	Exhaust gas temp. outlet from calorimeter(T4)	^{0}C																										
13	Atm. Pressure	bar																										
14	Atm. Temp	^{0}C																										
15	Gas Const.(R)	Kj/Kg K																										
16	% CO_2																											
17	% CO																											
18	% O_2																											
19	PPM																											

Fuel Properties

The main properties of the fuel will be tested as shown in Table 3.

Fuel	Gross Calorific Value	Viscosity (Poise)	Relative Density
A (D+J)			
B (D+J)			
C (D+J)			
D (D+J)			
E (D+J)			
Diesel			
Jatropha			
A1 (D+K)			
B1 (D+K)			
C1 (D+K)			
D1 (D+K)			
E1 (D+K)			
Karanja			
A2 (D+K+J)			
B2 (D+K+J)			
C2 (D+K+J)			
D2 (D+K+J)			
E2 (D+K+J)			